Heat of Formation

**Standard Enthalpy of Formation:**

Three steps for writing a Formation Equation:

1.

2.

3.

SATP means \_\_\_\_\_\_\_\_\_\_\_˚C and \_\_\_\_\_\_\_\_\_\_\_\_\_ kPa

Most metals are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at SATP

Five common gases at SATP are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Hg and Br2 are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at SATP

The enthalpy of formation of an element in its standard state is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If I need an enthalpy of formation, I can check the CHART!!

1. What is the thermochemical equation for the reacton of lime (CaO) with water?

CaO(s) + H2O(l) 🡪 Ca(OH)2(s) ∆H = ?

1. Ca(s) + ½ O2(g) 🡪 CaO(s) ∆H˚f = –634.9kJ/mol
2. H2(g) + ½ O2(g) 🡪 H2O(l) ∆H˚f = –285.8kJ/mol
3. Ca(s) + H2(g) + O2(g) 🡪 Ca(OH)2(s) ∆H˚f = –986.1kJ/mol

∆H =

*The enthalpy of a reaction is*

2. The main component in natural gas used in home heating or laboratory burners is methane. What is the molar enthalpy of combustion of methane fuel?

**ASSUME combustion yields CO2(g) and H2O(l)**

Check your chart:

* ∆H˚f methane =
* ∆H˚f oxygen =
* ∆H˚f carbon dioxide =
* ∆H˚f water (liquid) =

3. The standard enthalpy of combustion of benzene (C6H6) to carbon dioxide and liquid water is -3273 kJ/mol. What is the standard enthalpy of formation of benzene?

4. Nitric acid, required in the production of nitrate fertilizers, is produced from

ammonia by the Ostwald process. Use standard enthalpies of formation to calcu- late the enthalpy changes in each of the following systems.

1. 4 NH3(g) + 5 O2(g) → 4 NO(g) +6 H2O(g)
2. 2 NO(g) + O2(g) → 2 NO2(g)

(c) 3 NO2(g) + H2O(l) → 2 HNO3(l) + NO(g)

5. Try: *When octane burns in an automobile engine, heat is released to the air and to the metal in the car engine, but a significant portion is absorbed by the liquid in the cooling system—an aqueous solution of ethylene glycol. What mass of octane is completely burned to cause the heating of 20.0 kg of aqueous ethylene glycol automobile coolant from 10°C to 70°C? The specific heat capacity of the aqueous ethylene glycol is 3.5 J/(g* •°C). *Assume water is produced as a gas and that all the heat flows into the coolant.*